trinity

EROSION AND RESERVOIRE

SILTATION MANAGEMENT

BROCHURE

Erosion
Siltation
Water conflict
Reservoir volume loss
Stakeholder number reduction
Cost optimalisation
GIS based
Hot spot analysis
Erosion and Reservoire Siltation Management
Climate change analysis
Agro-chemicals
Conflict management

2023

CASE STUDY AND SAMPLE MAPS

Understanding Hydrology, Erosion and Eutrophication Modelling

The Power of PhosFate catchment model

Dear reader,

Among reduced water availability, water quality and siltation are the biggest threads to operation of reservoirs. Our state-of-the-art approach PhosFate has been a proven tool pinpoint area of intervention. We will tell you exactly where to interact, but even more we can calculate you the most cost-effective set of measures to achieve your aims with your reservoir management.

Our siltation management options are including small-scale low-cost measures, which can be performed by even the local villagers to complex engineering structures, from small cultivations methodology changes to large scale reforestation. We give you the right hinge of action.

No data, no problem to us our databases are covering the entire globe and based on our previous work your system can be calibrated. Moreover, with our Climate-change downscaling expertise we can.

Bence Fülöp

Chief Executive Officer

Trinity Enviro

WE HAVE WORKED

ON EROSION MANAGEMENT IN THIS:

COUNTRIES

Albania

Switzerland

Brazil

Romania

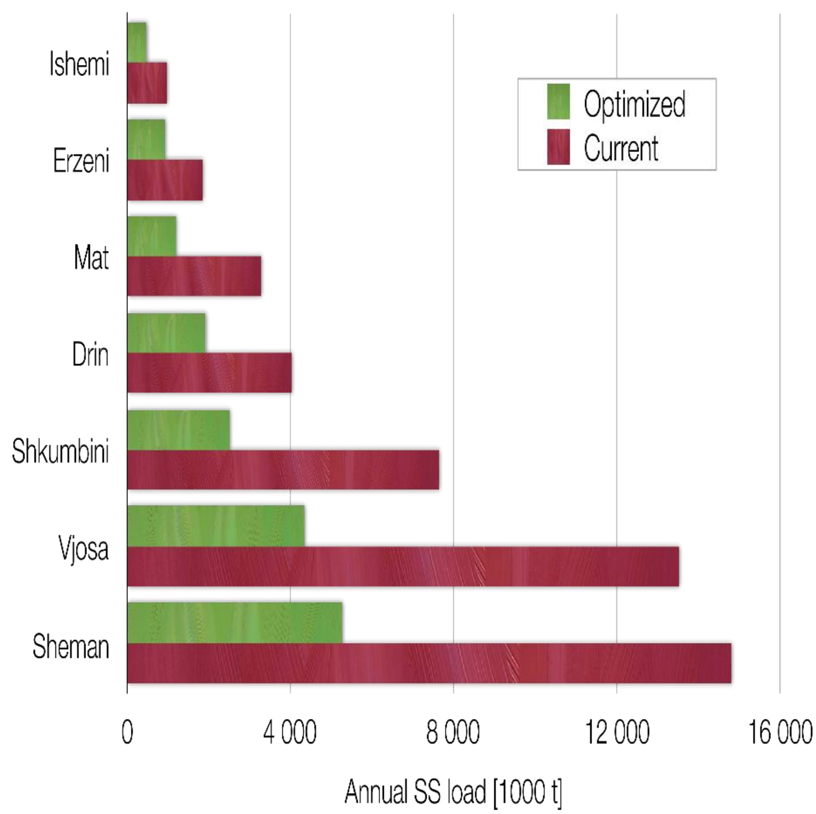
China

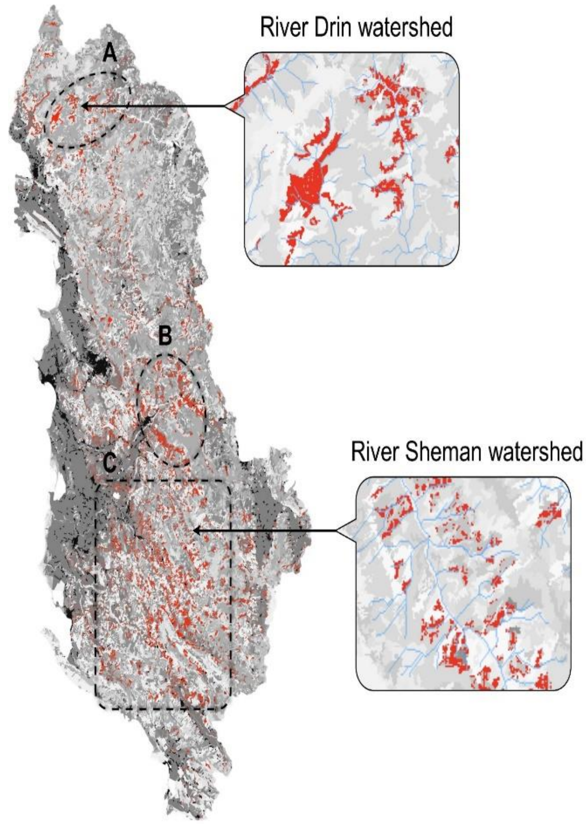
Hungary

Uganda

Lebanon

SEE ON PICTURES





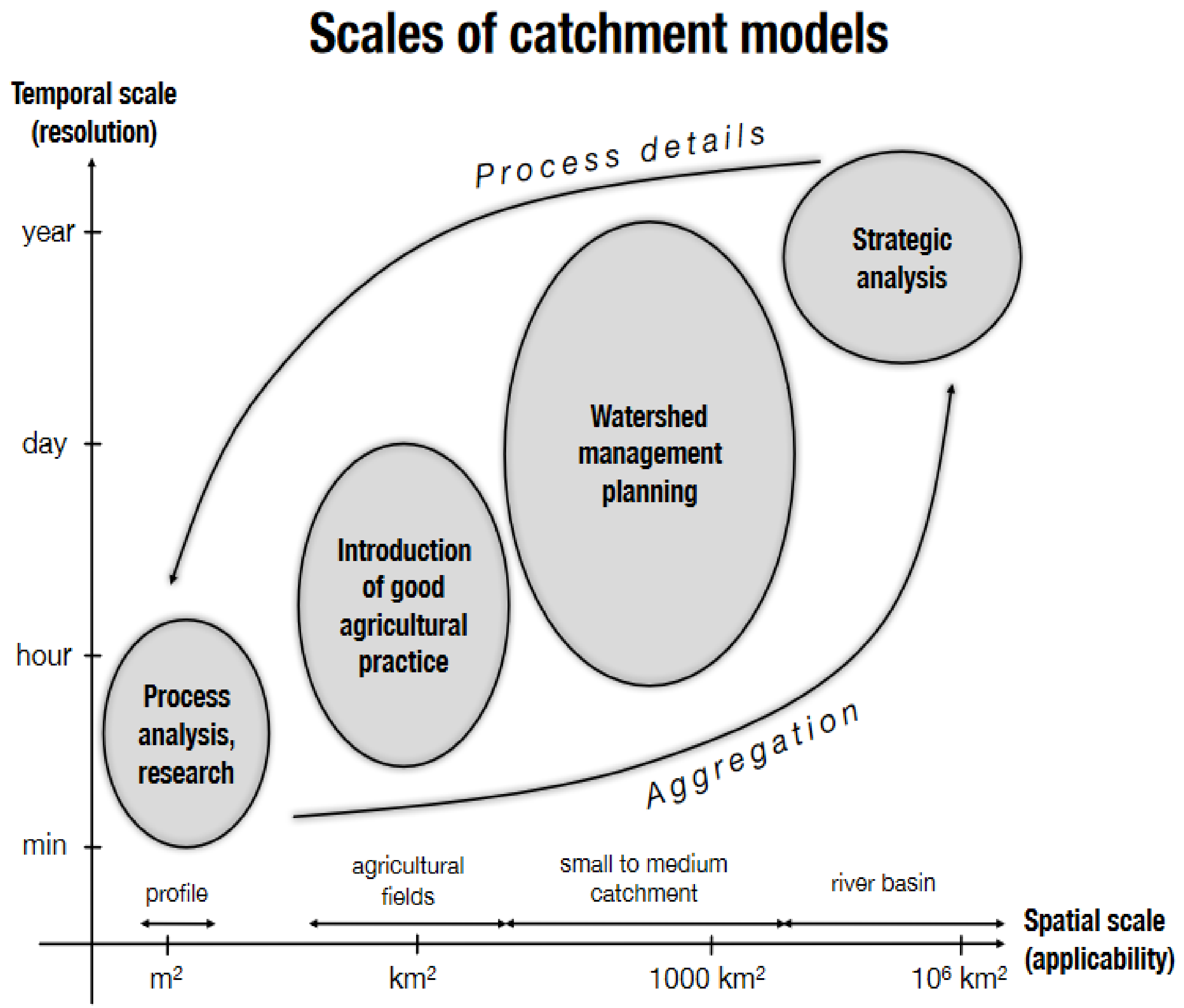
CASE STUDY

MŰEGYETEM 1782

Hydrology, Erosion, and Eutrophication Modelling

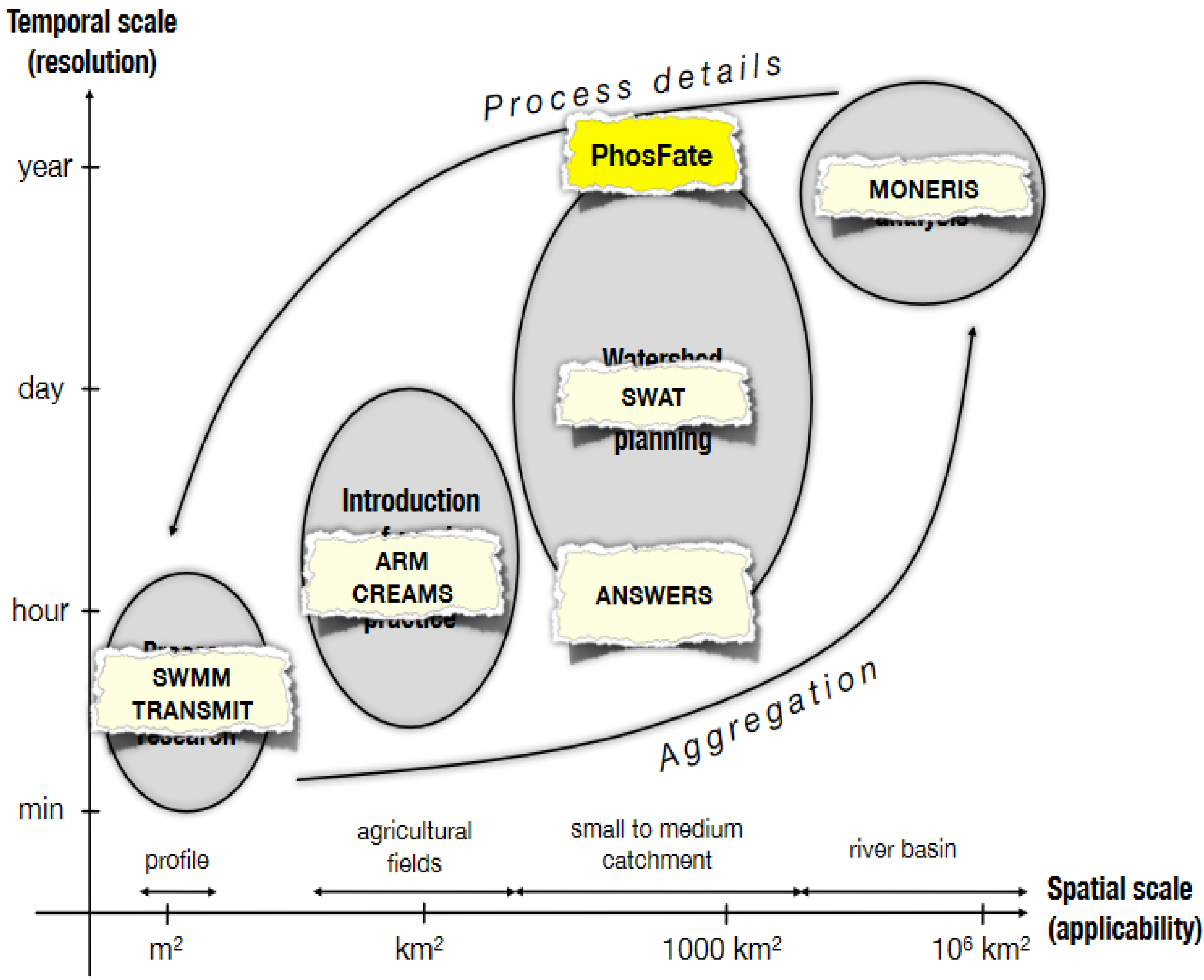
with the PhosFate catchment model

Mark Honti PhD
Hungarian Academy of Sciences



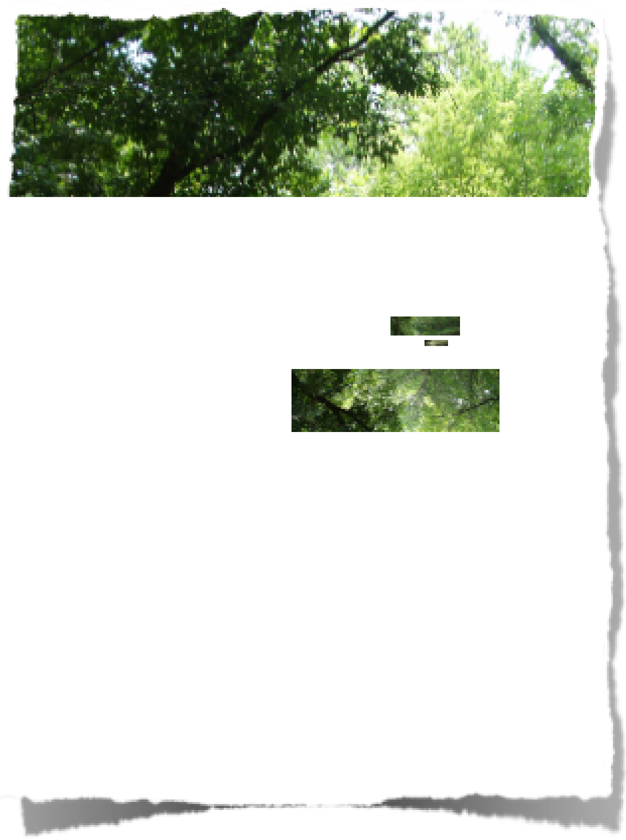
Scales of catchment models
Temporal scale
(resolution)
year
day
hour
min
Process details
Aggregation
Process
analysis,
research
Introduction
of good
agricultural
practice
Watershed
management
planning
Strategic
analysis
profile
agricultural
fields
small to medium
catchment
river basin
m²
km²
1000 km²
10⁶ km²
Spatial scale
(applicability)

Scales of catchment models

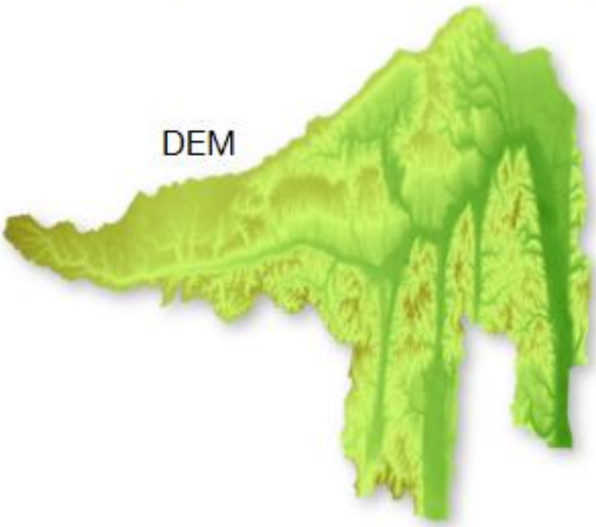


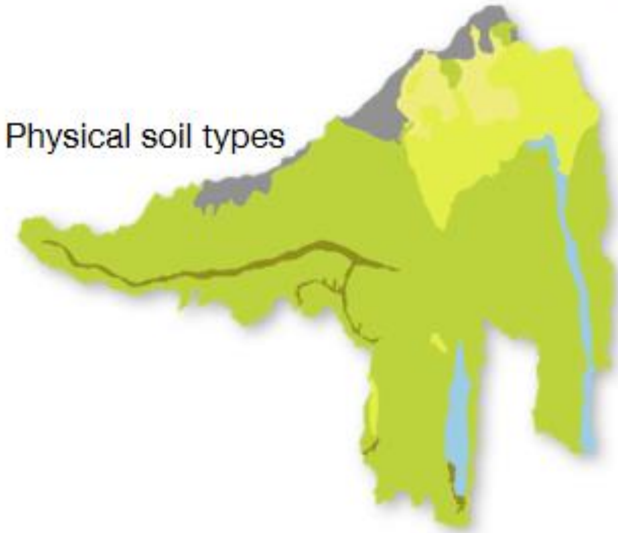
PhosFate (Phosphorus Fate) method

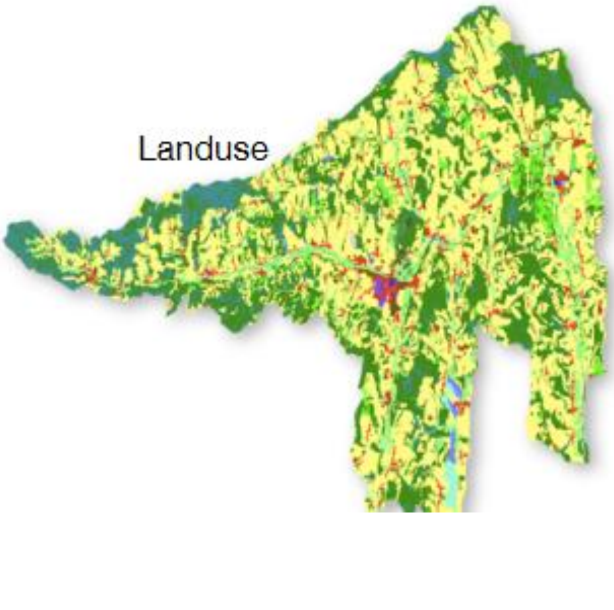
- Decision support system for catchment management by designing BMPs developed at BME
- Hydrology, erosion and transport model with a GIS interface
- Planning BMP scenarios and assessing their impacts, comparison of water quality impacts and expected costs
- Localization of hot spots, optimization
- Simulation of climatic and fertilizer application changes



Input data: mostly maps from remote sensing

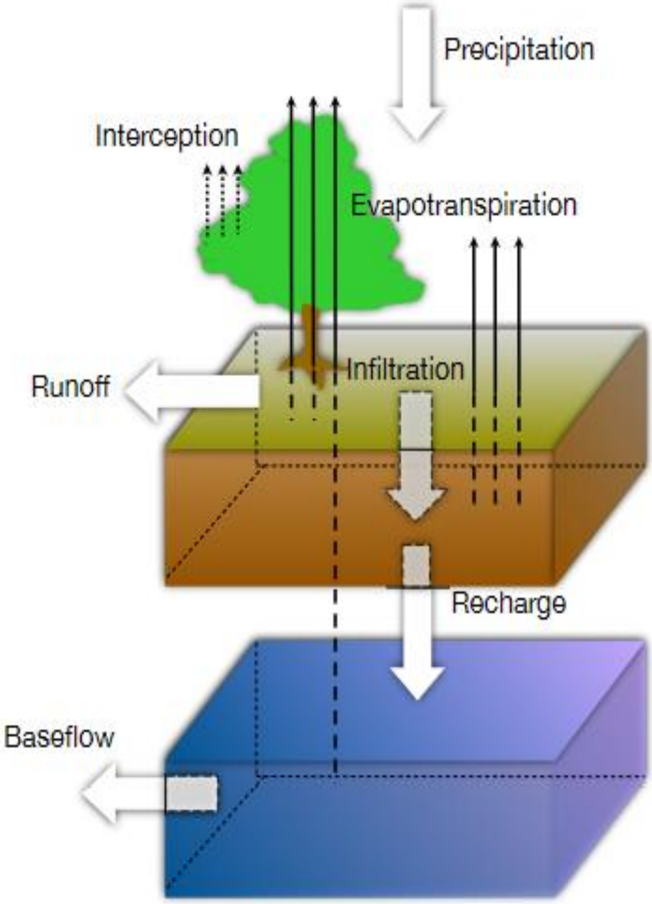


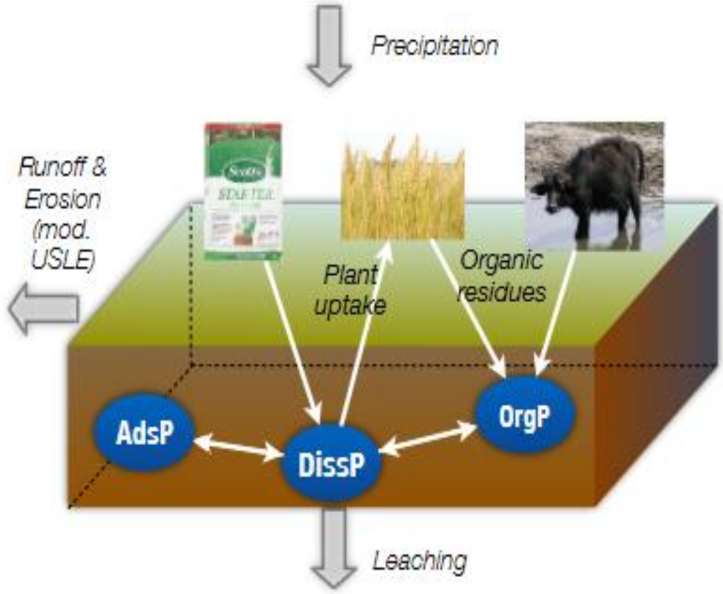




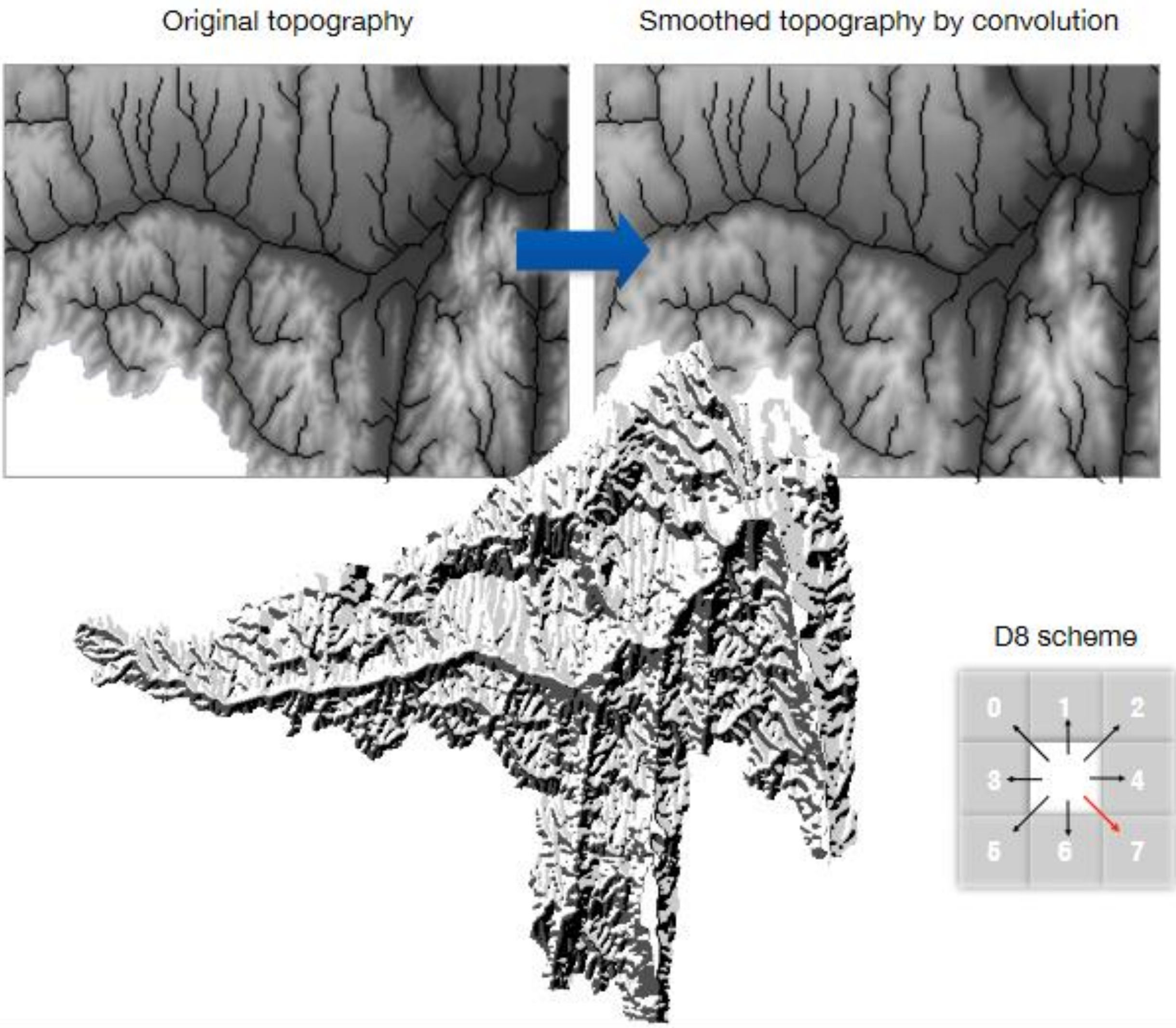
- Additional data (if available):
  - Soil properties
  - Meteorology (mean rainfall, temperature, wind speed)
  - Agricultural statistics (fertilizer/manure if nutrient management is planned)
  - Point sources and reservoirs

Water/sediment/nutrient balance for each map cell





Determination of the hydrologic tree



Determination of the hydrologic tree (2)

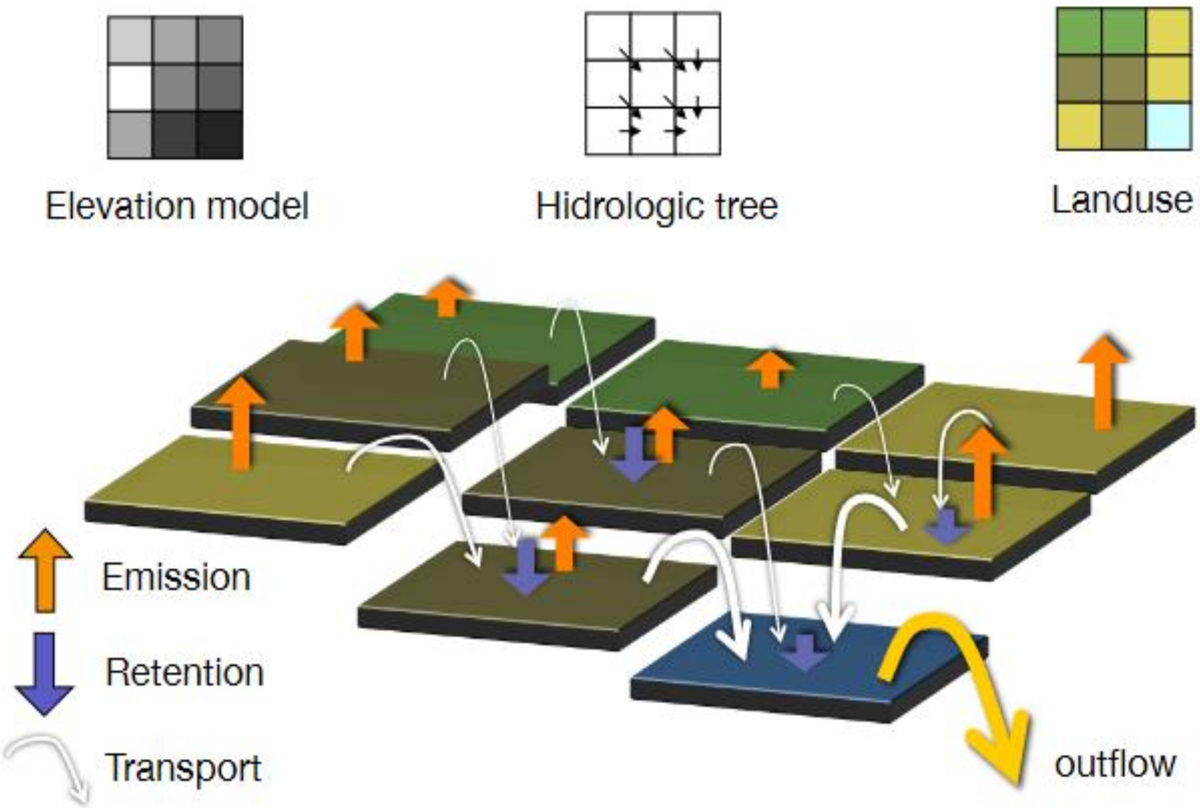
Sinks were joined by inundation method (without modifications to the DEM)

On the raw DEM (2959 sinks)

After the 1st inundation round (73 sinks)

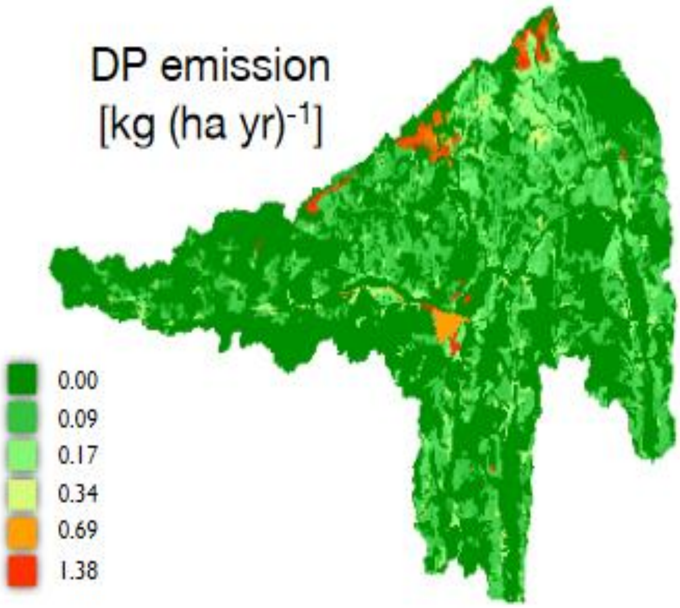
Transport scheme

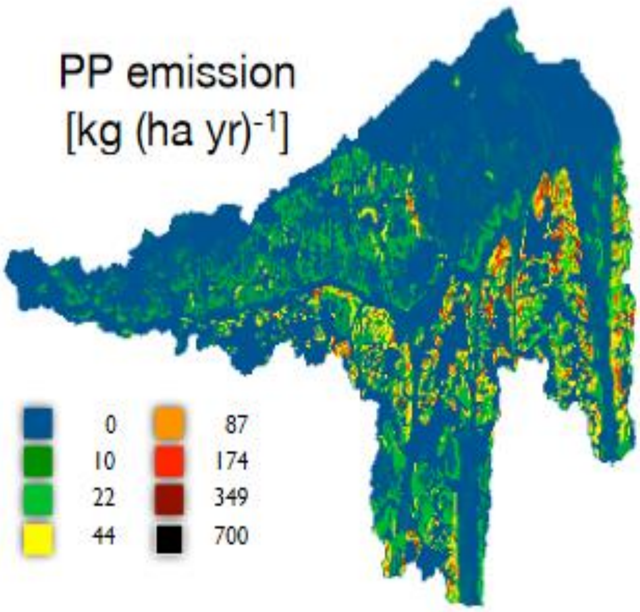
Materials are transported between map cells



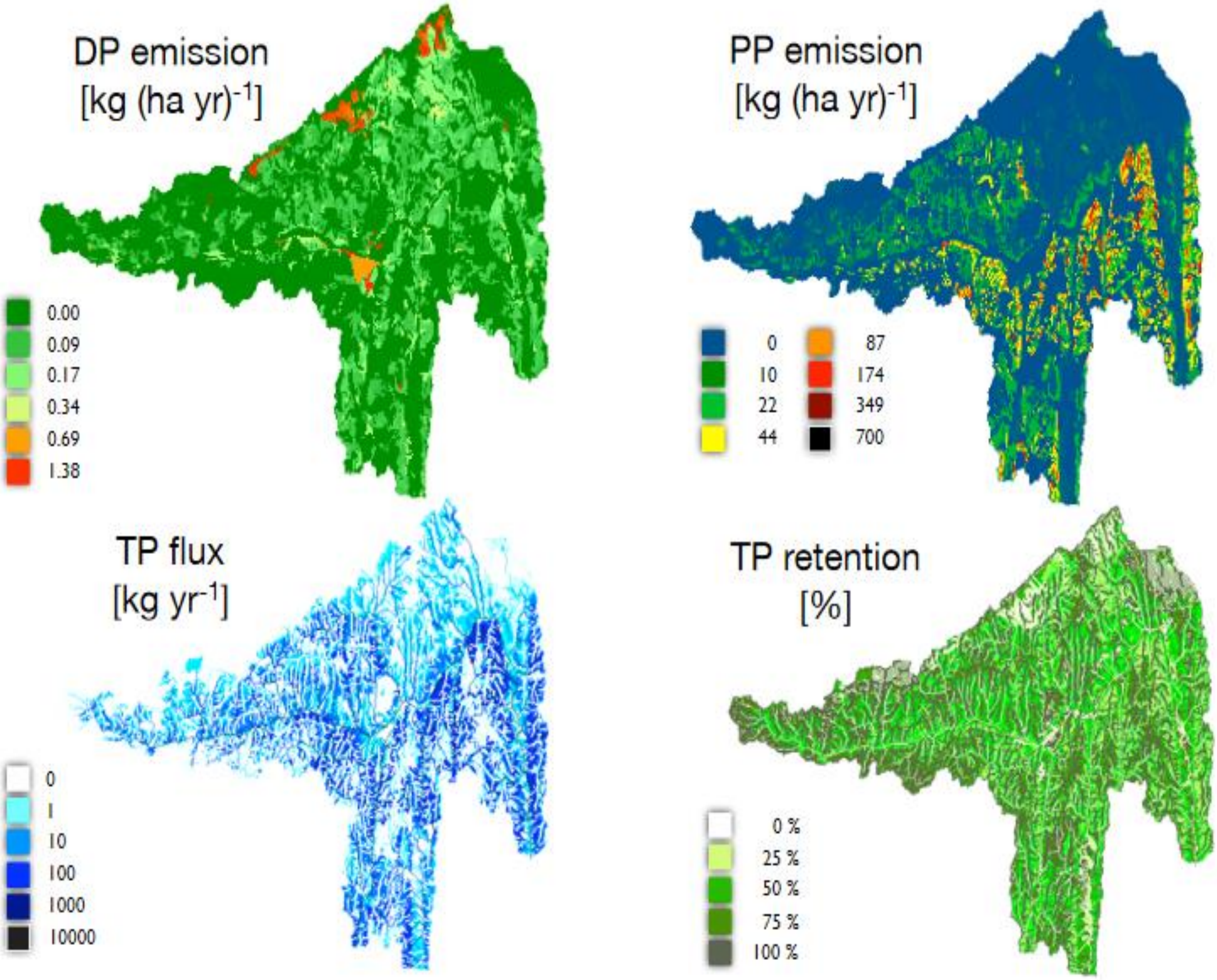
Products: maps

- Flow routing / stream network
- Discharge and hydrological parameters (ET, runoff, baseflow)
- Erosion and sediment transport
- Phosphorus fluxes on land and in water
- Algal concentrations in streams
- Optimised landuse

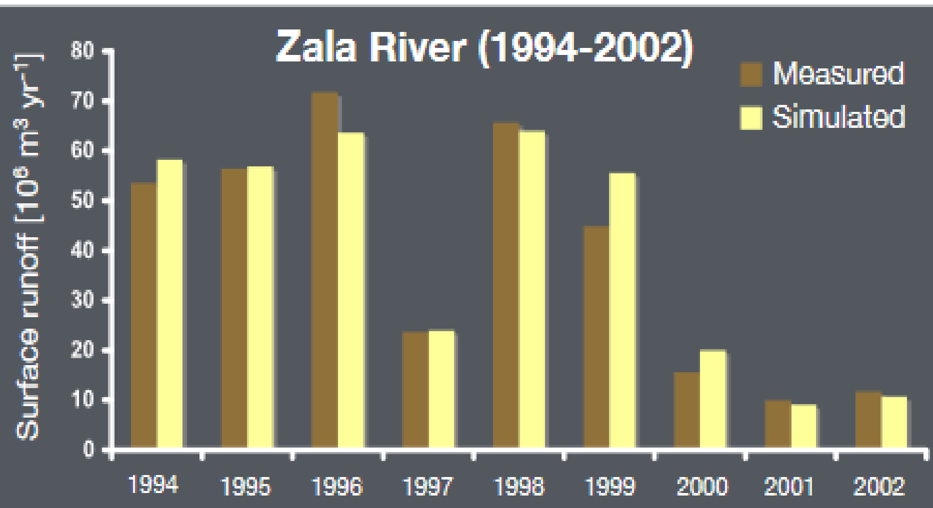


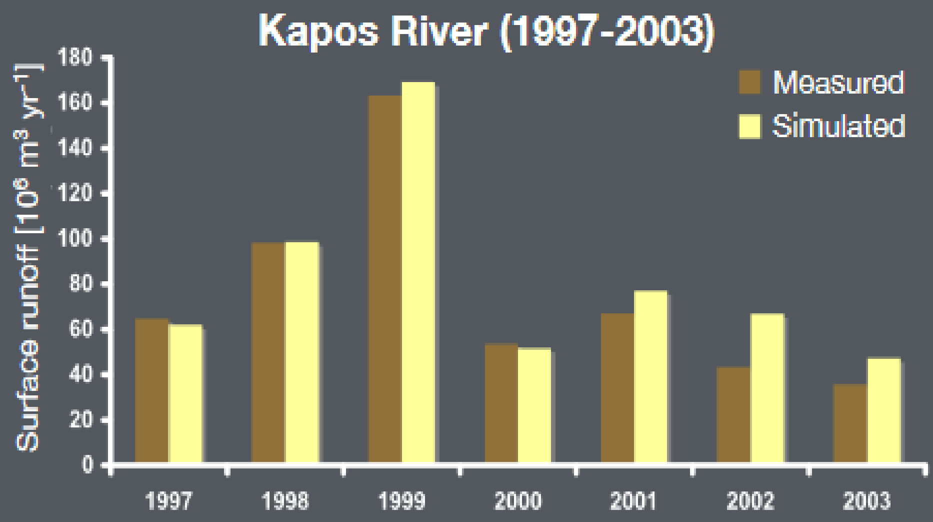


Spatial patterns in P transport (avg. of 10 years)

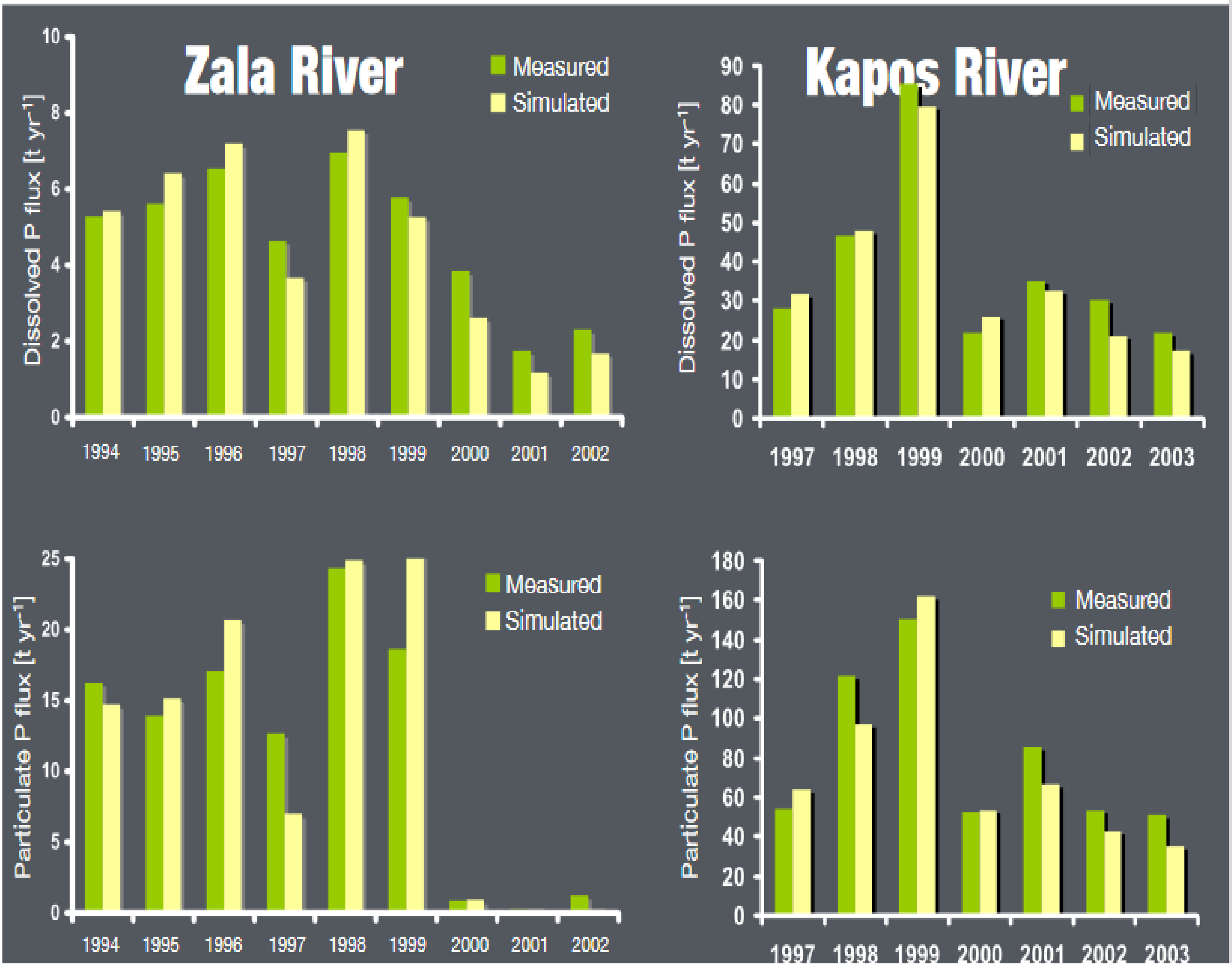


Comparison with monitoring data (hydrology)





Comparison with monitoring data (nutrients)



Case study: “Blind” erosion management options

BMPs prescribed without inspecting local conditions

Intervention in ***sensitive*** areas: riparian zones, erosion source areas (soil loss > 1 mm yr^{-1})

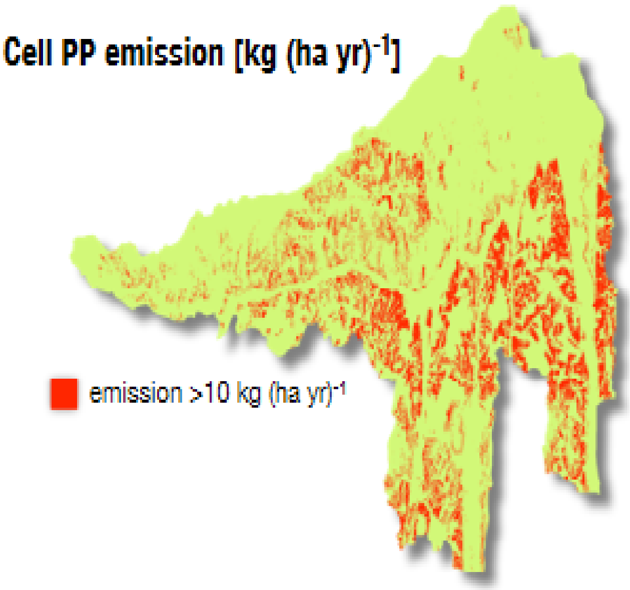
Management options (BMP application):

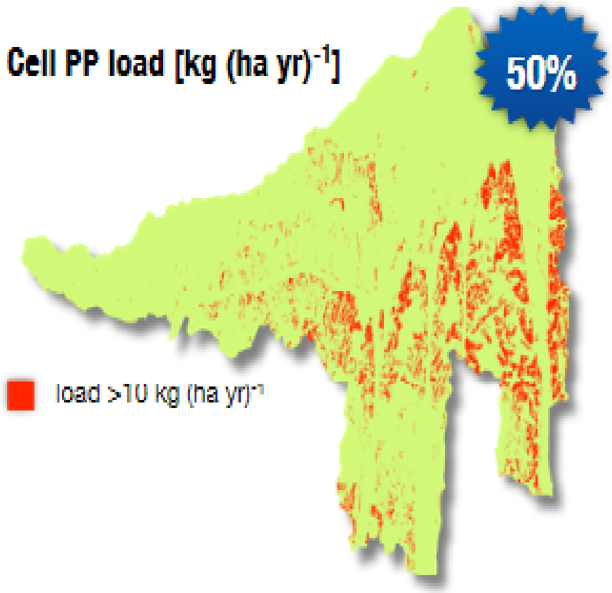
I. Forestation
II. Riparian buffer zone, filter strips
III. Strip-cropping
IV. Mulching
V. Combination (I. + II. + IV.)

Option	Area [%]	Load red. [%]	Cost [10^6 USD]	Spec. rem. cost [USD/kg P]
I. Forestation	14	**68**	5.4	297
II. Rip. buffer zone	3	39	**1.0**	**95**
III. Strip-cropping	14	53	2.8	196
IV. Mulching	14	5	3.7	231
V. Combination	16	**69**	4.7	25

Case study: Optimised BMP planning

- Impact on streams: “location, location, location”
  - Not all erosive spots contribute to stream load,
  - Not all banks need a buffer zone.
- **Interventions should target:**
  1. Top sources of the exported flux (source control)
  2. Top transporters of the exported flux (transport control)
- **Objective function = technical/economic efficiency:**
  1. Minimize pollution using a fixed cost
  2. Minimize costs while respecting a given pollution limit





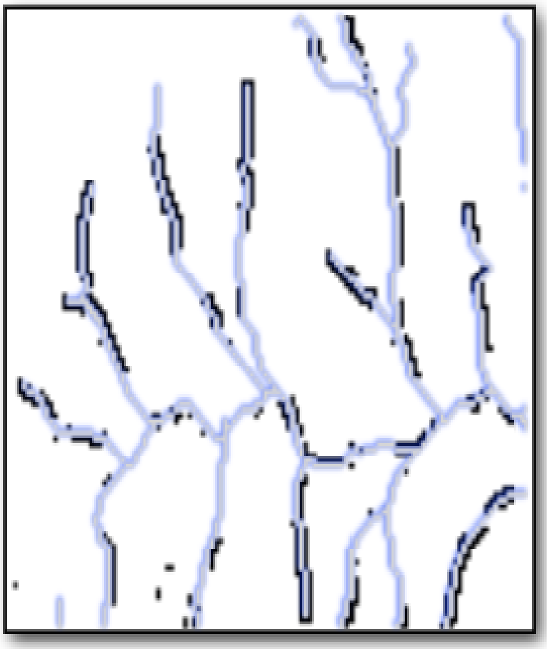
Optimized management

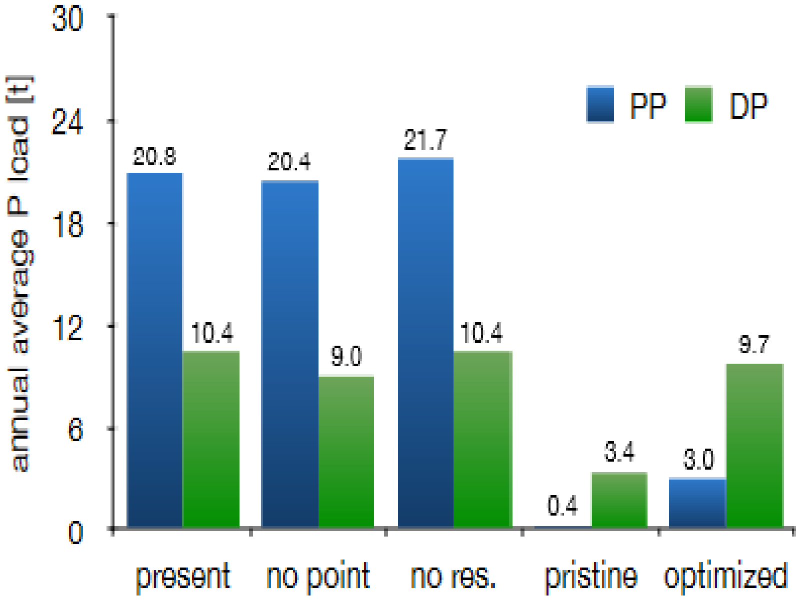
Most loads enter a low-ordered stream

Transport control is more effective than source control (w.r.t. water quality)

Preferred measure: buffer zones along small streams

Source control is only applied if transport control needs support



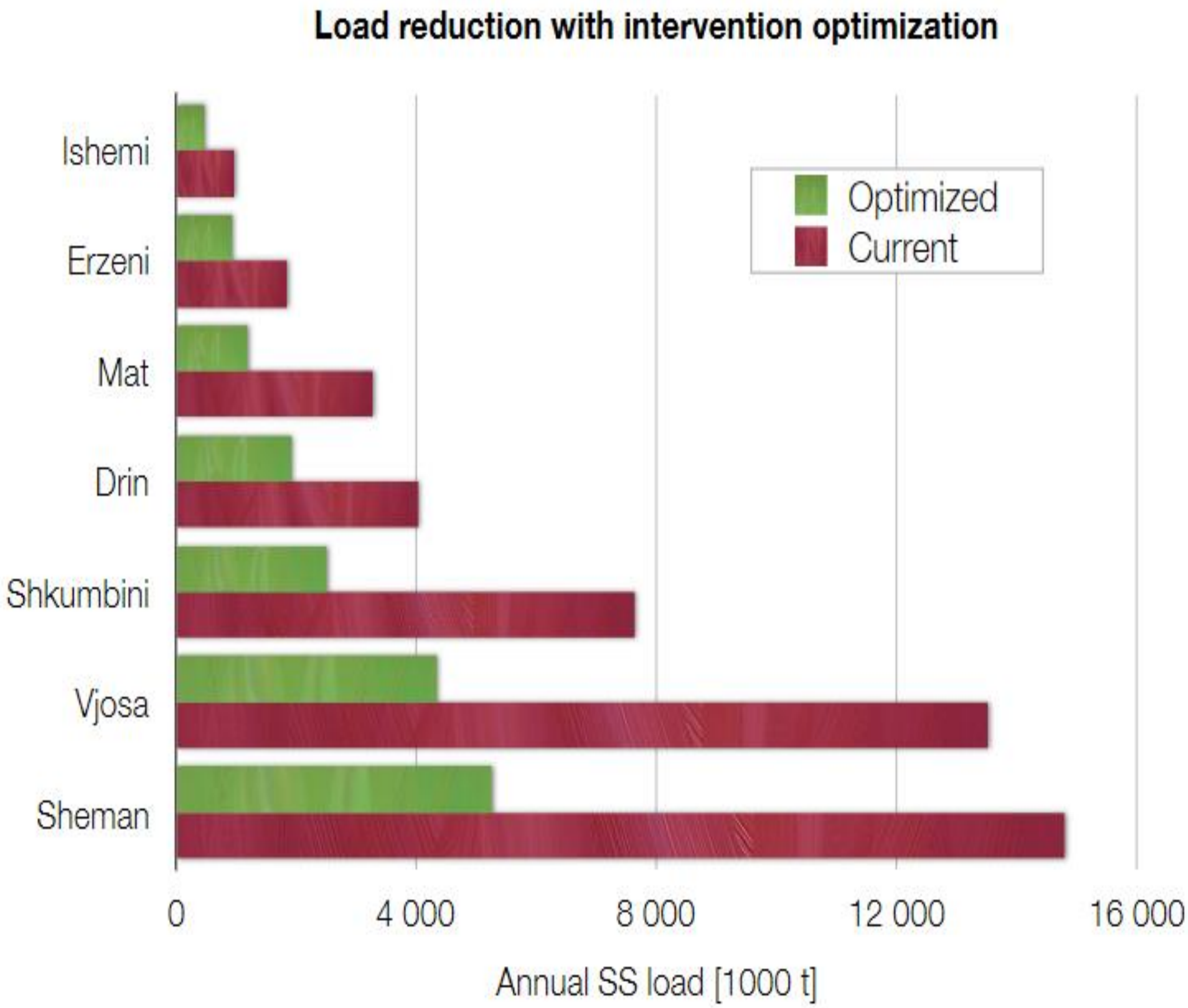


Management option	Affected area [ha]	Cost [10^6 USD yr^{-1}]	Load reduction [%]	Specific cost [USD (kg P $yr)^{-1}$]
V. (combined)	23 600	4.7	69%	249
Optimized	10 373	2.3	72%	113

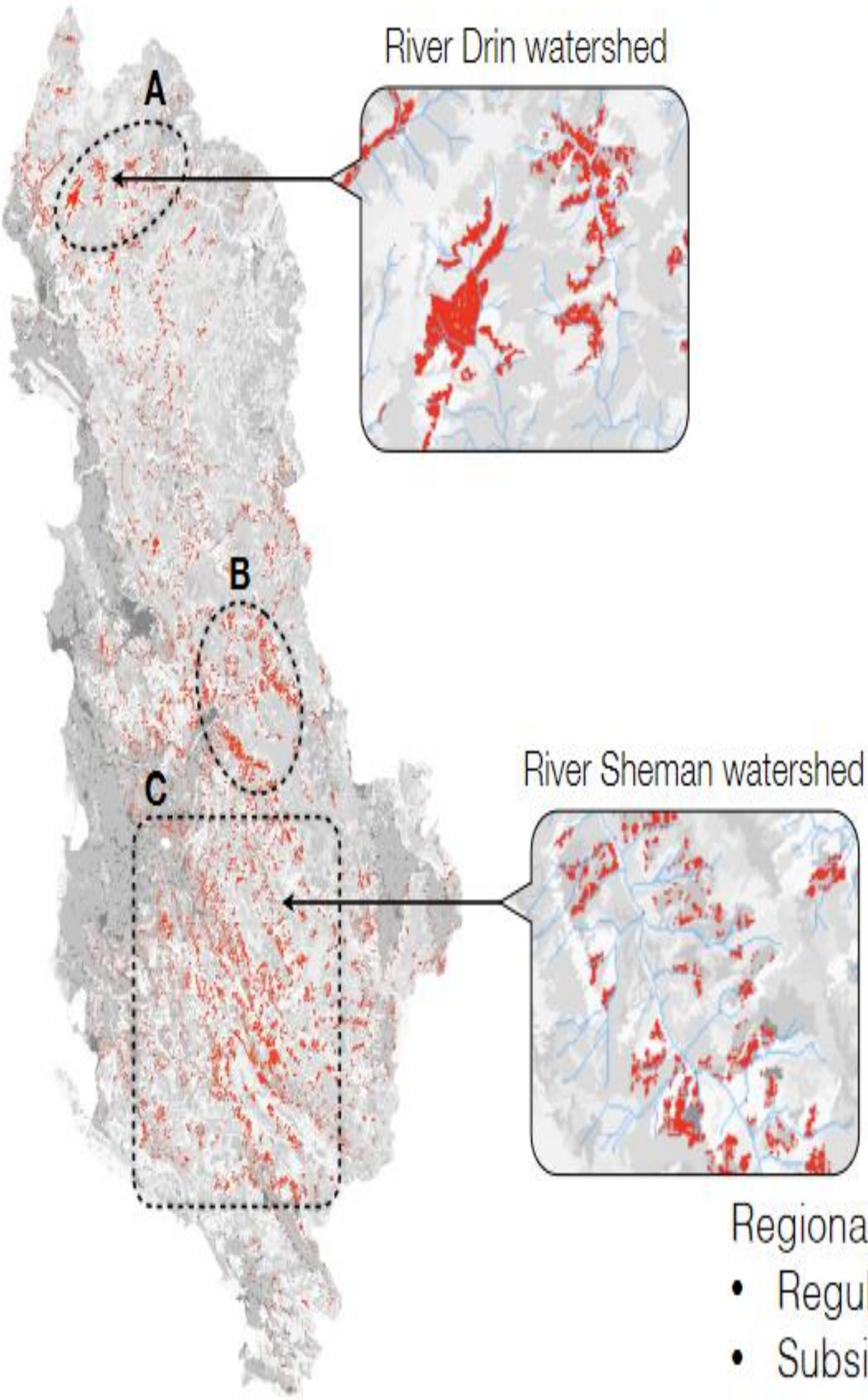
Lack of data: Erosion and reservoir siltation study for Albania (Europe)

- Erosion and siltation assessment for the entire country (28,000 km^2)
- Soil erosion, sediment fluxes in rivers
- Design regional management
- Practically no local data available
- Using global and European databases

Modeling can be still used to set targets and to design large-scale measures

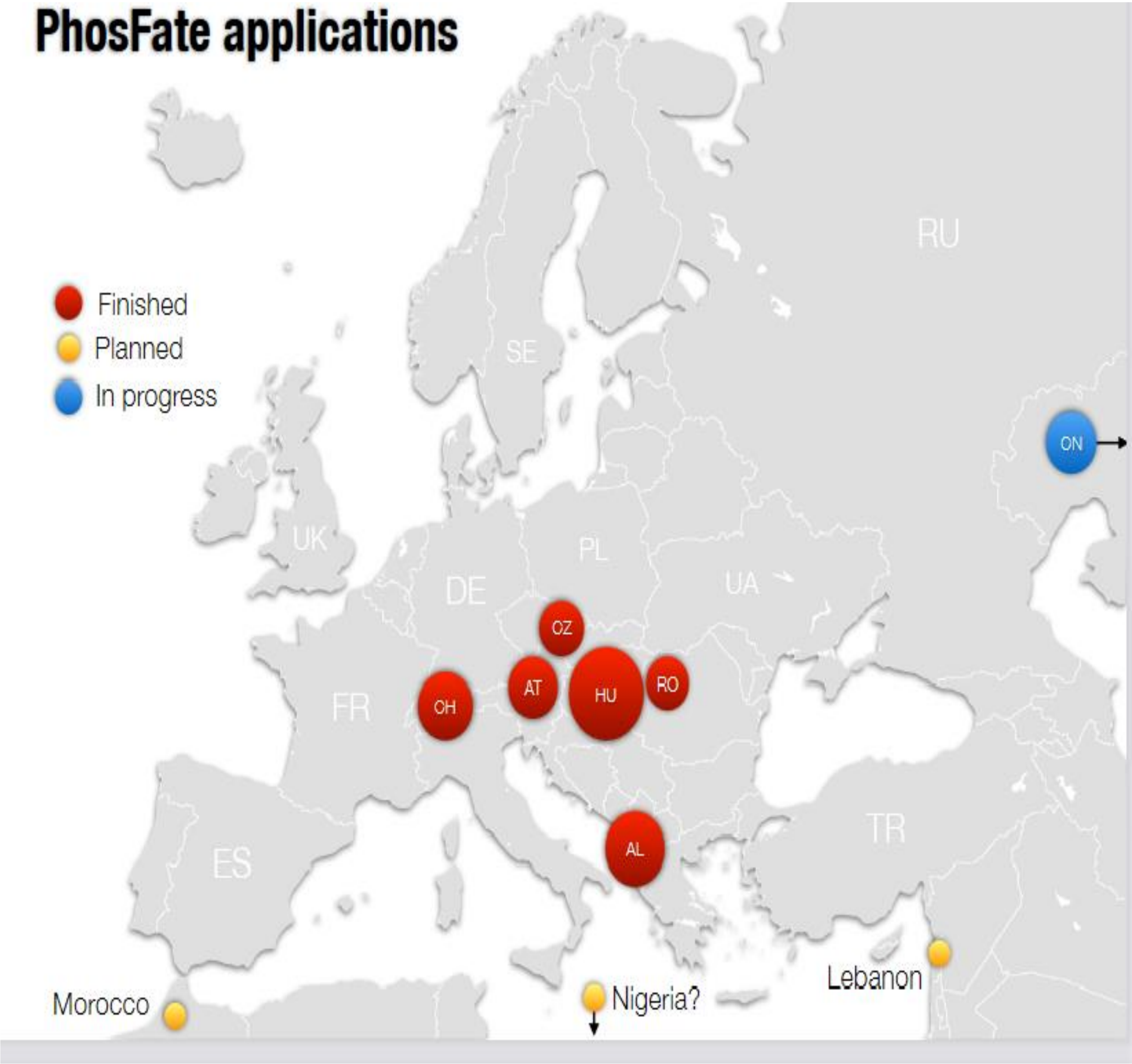


Optimized intervention locations: identifying hot-spot regions



Regional management policies

- Regulation
- Subsidies for farmers


PhosFate applications
Finished
Planned
In progress
RU
SE
ON
UK
PL
DE
UA
OZ
AT
HU
RO
FR
CH
TR
ES
AL
Lebanon
Morocco
Nigeria?

Summary

- PhosFate is a novel GIS design tool for catchment management with very limited data demand
- Calculates stream network, stream discharges, erosion, non-point nutrient pollution and river trophic state
- Optimisation algorithm included to mitigate soil loss and river pollution in a cost-effective way with small landuse changes
- Especially suited to cross-border investigations as it has a low data demand